vulsive stage could be eliminated some might have a faint chance for recovery. In case the patient dies, the chloroform will have saved him from the agonizing mental state which such patients pass through. One other attempt can be made, namely, the administration of the serum of an immune animal or person. As much blood should be withdrawn as the individual's strength will allow, and, after separating the serum and red corpuscles, injected in graduated doses. This is partly speculative and will require a great deal of experimental work to show its real value. There is still room for a great deal of experimental work along lines of the true etiology of rabies and the treatment of developed cases.

In the preparation of this paper I am greatly indebted to Dr. R. L. May for the privilege of the post-mortem materials, to Dr. H. R. Mills for assisting in the post-mortem and the subsequent work in the laboratory, and to Dr. Iva C. Youmans, Drs. Mills and Youmans having had the largest part of the routine examinations in our recent rabies epidemic.

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RECENT EXPERIENCES IN THE ARTIFICIAL FEEDING OF ONE HUNDRED INFANTS

DURING THE FIRST THREE MONTHS OF LIFE *

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The experiences recorded in this paper were noted during the past year in the care of foundlings in a maternity home for unfortunate girls. No private cases are here included, so that my conclusions as to feeding-results are not so favorable as would be found in the handling of a similar number of cases in homes.[1] The material at hand included infants some of whom were fed at the start on breast-milk, but few of whom continued longer than two weeks. In many of these breast-milk cases the patients were wet-nursed and some fed on mixed milk drawn by the breast-pump. It would be almost impossible to trace any phenomena while the infant was on breat-milk to a cause in the milk or wet-nurse, as the handling of the infants was entirely separate from that of the mothers or wet-nurse, about whom I knew nothing except that syphilis had been carefully excluded. Wherever possible an infant at birth or in a nutritional illness was given a start on breast-milk, and this food was, of course, continued as long as breast-milk was available.

All cases were, therefore, problems for artificial feeding at varying periods, beginning at birth or within two or three weeks thereafter.

I wish to speak first of the initial loss of weight and the rectal temperature in both breast-fed and bottle-fed infants which our records show.

INITIAL LOSS OF WEIGHT

As has been stated by many observers, notably by Griffith and Gittings,[2] the breast-fed baby continues to lose weight for the first two to four days. The feature in which I was most interested was as to the day on which the child had regained the amount of its birth weight. In Schaeffer's series, 44.5 per cent. of infants were still under weight at the fourteenth day.[3] In the ninety-five cases of Griffith and Gittings, thirty-one did not regain their weight until after the fourteenth day. In my series of sixty breast-fed infants, eight did not show any loss of weight at the end of twenty-four hours, nor later. Four of these were wet-nursed from the start. With the other four, I could find no explanation as to why they so quickly recovered their primary weight. The average number of days was eleven while the longest was eighteen.

CASE 1.—Baby H., weighed 3,725 gm. at birth, had lost 305 gm. at the end of twenty-four hours, began to gain on the fourth day but did not regain birth weight until the eighteenth day, after which the gain was regular. The child showed no febrile nor other disturbance and was nursed by the mother, whose condition was reported good.

In those infants that were given the bottle from the start, and that thrived, the return of the initial weight averaged no slower than the breast-milk babies. One infant on the bottle had about regained its birth weight at the end of twenty-four hours and continued to gain as follows:

CASE 2.—Baby O., weight at birth 3,660 gm., was placed at once on half buttermilk and water. The second day the child regained to within 5 gm. its initial weight, and showed a gain of 100 gm. on the third day. A small amount of malt sugar to gain slowly when at the eleventh day there had been a total increase of 300 gm. above the initial weight.

RECTAL TEMPERATURES IN INFANCY

There is quite a difference in the text-books regarding the normal rectal temperature in the new-born. Rotch states that about a week following birth it is 98.2 F. Fischer places it between 99.4 F. and 100 F. Koplik believes that a temperature above 100.4 F. is abnormal. One frequently hears it stated that the temperature in the mouth is one-half a degree higher than in the axilla, and that of the rectum one-half a degree higher than that in the mouth. Therefore, assuming that the axillary temperature is 98.6 F., it has often been erroneously concluded that the normal rectal temperature is 99.6 F. In several years of routine temperature taking in the children's dispensary, I seldom saw normal temperatures above 99 F. It was for the purpose of convincing myself as to whether 99 to 100 F. is rare and should be regarded as pathologic in infants, that a study of seventy infants was made, first in the infants during the first nineteen days of life, and a second in infants up to six months of age. Sixty of these were on the breast for an average of nineteen days, ten were bottle-fed from the start. Nineteen days was the average that babies were fed on the breast, hence the new-born bottle babies were considered only for nineteen days. No difference was found in the normal temperature of breast- and bottle-fed, and the temperatures averaged the same in infants of this age as in those whose temperatures were taken up to three months, only a few of our cases remaining in the institution up to six months. The temperature was taken twice daily, at 8 a. m. and 6 p. m., just before bathing and feeding. The temperature of one child averaged 97.2 F., while eleven others averaged between 97.5 and 98 F. One infant alone showed an average temperature above 99 F., it being 99.4 F. Only those infants who were not premature, and who were running a consistent temperature while they were clinically well, were considered. The average of 2,660 temperatures was 98.6 F. The temperature at 6 p. m. averaged 0.07 F.

* Read in the Section on Diseases of Children of the American Medical Association, at the Sixty-Second Annual Session, held at Los Angeles, June, 1911.

1. In Arch. Pediat., February, 1911, Dr. Glazebrook describes the Speedwell Country Homes idea of Dr. Chapin, a movement which will be appreciated by all who have had the sad experience of fighting the mortality in a foundling asylum.

2. Griffith and Gittings: Arch. Pediat., May, 1907.

3. Schaeffer: Arch. f. Gynäk., 1896, p. 2282.

above the morning temperature. So consistently was there some apparent disturbance in the infant whose temperature ran above 99 F. (only one of the infants in this number had an average reading of over 99 F.), that it has confirmed my earlier convictions that a temperature between 99 F. and 100 F. should be regarded as pathologic.

EFFECT OF PEPTONIZATION OF THE MILK

During the year we frequently peptonized the milk, adding the extract of pancreas and bicarbonate of soda to the bottle ten minutes before use. The milk was peptonized for many of the new-born and for many of those infants who were not gaining in weight, with the hope of finding a favorable effect. An occasional increase had been demonstrated to me by Rosenstern at the Berlin Kinderasyl. For many years in difficult cases physicians have used some form of peptonizing in feeding, often combining it with milk sugar. Undoubtedly we have all seen an occasional good effect. During the past year we have had but two cases in which gain could be attributed to peptonization. One was in an infant fed on buttermilk to which was added malt sugar. There had been no increase in weight for several weeks, the bowels and digestion, however, being clinically normal. One-third of a peptonizing tube was added to each bottle of the buttermilk preparation, with an immediate gain in the infant's weight.

CASE 3.—Baby O., aged 3 months, had gained regularly on malt soup containing two-thirds full milk of 3.4 per cent. fat, but at this time there had been no gain for ten days. The milk was peptonized, the weight increasing 211 gm. in the next two days, and continued to increase thereafter.

No favorable effect in all of forty cases was observed by peptonizing the food of the new-born infant.

EXPERIENCES WITH BUTTERMILK

The buttermilk which we have used was churned daily in the institution from top milk soured naturally at the room temperature or by the addition of a small amount of the previous day's buttermilk. In warm weather, the top milk frequently becomes sour in half a day at which time it is put on ice until ready for churning. A glass rotary churn has proved satisfactory and can be completely sterilized. As small a quantity as one quart may be churned at one time if desired.

In many of the infants that were difficult to feed, buttermilk was employed, and also in all cases of atrophy. As long as the child thrived it was kept on buttermilk, even through a period of several months, with the gradual addition of top milk. Our experience has been that it exerted a beneficial therapeutic effect in mild enterocolitis cases and that such cases developed less commonly among the infants who had been fed on buttermilk.

CASE 4.—Baby W., a healthy child, weighing 3,530 gm. at birth, fed on the breast for ten days, and then on a sweet-milk formula containing 2.5 per cent. fat for the next twenty days, during which time it gained only 150 gm. At this time we began using half buttermilk and water with the addition of 1 per cent. fat in the form of top milk. During the next twenty-three days the infant gained only 200 gm. The top milk was then withdrawn, the buttermilk was increased to two-thirds, and the water one-third, the infant gaining 800 gm. in the next twenty days, after which it was taken from the hospital.

Buttermilk proved of special value in the summer months, at which season it was better tolerated and produced better stools than the same patient would probably have had if fed on a sweet-milk mixture.

SKIMMED MILK

Some of the infants who had an apparent intolerance for fat and who took buttermilk easily, thrived for a time on skimmed milk. One child that had a simple loss of weight on mixed breast-milk showed a remarkable gain when put on skimmed milk with malt sugar. The routine was followed with a series of new-born infants of starting them on a dilution of skimmed milk with enough maltose to bring the total sugar up to 7 per cent., as low as one-third skimmed milk to two-thirds water. When an infant ceased to gain or failed to show any increase, top milk was added from time to time to bring the fat content up 0.5 per cent.

This method has given much better results in most cases than arbitrarily starting an infant at birth on a fat-containing milk with a higher caloric content that the infant needs or will tolerate.

MALT SOUP

Thirty infants were fed on malt soup for varying periods. Those that did not thrive were next tried on different quantities of the ingredients.[4] Four formulas were used, called Malt Soup A, B, C and D.

MALT SOUP A

(Keller's formula, with the exception of the flour, which is here reduced one-half.)

4 tablespoonfuls of malt soup extract, dissolve in 18 ounces of warm water.

4 level tablespoonfuls of wheat flour mixed with 4 ounces of water, and any lumps of flour strained out.

These are added and brought to a boil in double boiler, stirring all the time, and then boiled for five minutes.

Cool and add 11 ounces of whole milk.

MALT SOUP B

2 tablespoonfuls of malt soup dissolved in 18 ounces of warm water.

2 level tablespoonfuls of flour dissolved in 4 ounces of water.

Cool and add 11 ounces of whole milk.

MALT SOUP C

4 tablespoonfuls of malt soup dissolved in 12 ounces of water.

2 tablespoonfuls flour in 4 ounces of water.

Cool and add 17 ounces of whole milk.

MALT SOUP D

2 tablespoonfuls malt soup dissolved in 12 ounces of water.

2 level tablespoonfuls flour in 4 ounces of water.

Cool and add 17 ounces whole milk.

In these, the quantities of flour, malt soup extract and milk were varied, and were given according to the needs of the individual cases. These changes proved necessary and successful in many cases. Other modifications besides these four regular formulas were also used.

Infants under two months of age did not show the gain found in those who were older. We have used malt soup preparations in the majority of the infants and have been favorably impressed with its tolerance by infants above two months of age. The milk is not to be boiled or added until the malt soup is cooled, so that there need be no fear of scurvy.[5]

CASEIN MILK

The present German literature regarding experiences[6] with *Eiweiss-Milch*[7] is voluminous and favorable,[8] while comparatively little has been published in this country that has given practical proof of its merits.[9] Those who have seen its use demonstrated by Finkelstein and Meyer have felt that in theory it is correct and

4. Holt: Diseases of Infants and Children, Ed. 5.
5. Thomas: Ohio State Med. Jour., 1907.
6. Welde, E.: Therap. Monatsh., 1911, xxv, 83.
7. v. Reuss: Gesellsch. f. inn. Med. in Wien., January, 1911.
8. Birk, W.: Monatschr. f. Kinderh., 1911, ix, No. 3.
9. Leopold: Arch. Pediat., August, 1910.

works successfully in their hands. That artificial feeding will always be a greater problem in the United States and in those other countries which have such extremes of summer heat than it is in the more moderate climate of Germany is evident. Therefore, it is not to be expected that casein milk will show so favorable results here as reported by the German observers. After twenty-four hours of a hunger diet, the use of a practical whey-free preparation, leaving out the buttermilk, such as we have employed in some cases of alimentary intoxication with diarrhea, was, in the favorable ones, attended by an improvement in most symptoms, but the rapid fall in weight was so alarming that the addition of buttermilk or sugar was imperative. When buttermilk was added to the casein milk, as advised by Finkelstein and Meyer, we saw no better results than by the use of buttermilk alone.

MALT SUGAR

Accepting the German teaching[10] regarding milk sugar[11]—that it is not so well absorbed as maltose, that it frequently causes a rise in temperature, and that it has the smallest influence on the body growth—we have used malt sugar in all cases that did not gain in weight and in many normal cases as a routine. Maltose is undoubtedly slower to ferment in the intestinal tract than is lactose.[12] With the advent of hot weather, it was found that the milk sometimes curdled after the addition of the malt extract, in which case the acidity of the malt was neutralized by the addition of carbonate of potassium, 4.8 gr. to the ounce of glycerinized malt extract. Many patients showed a gain in weight which could not be ascribed to any other cause than the change from milk to malt sugar. In some constipated infants, the change to malt sugar markedly improved the condition and frequency of the stools.[13]

CONCLUSIONS

From observations on one hundred infants in this institution during the past year, the following conclusions have been reached:

1. The average length of time before an infant regains its initial weight is eleven days.

2. The rectal temperature of infants under six months of age is 98.6 F. This method of taking should be employed exclusively, so as to avoid the misunderstanding which often exists regarding the indefinite mouth and axillary readings. A temperature of 99 F. or above is suspicious and should be regarded as pathologic.

3. Peptonization of milk showed no advantages in the new-born, but is occasionally beneficial in older infants.

4. Buttermilk is a useful food in some cases, even in the first weeks of life, and where breast milk is not available, should be tried in cases of fat intolerance and in enterocolitis.

5. Some infants showed increased weight when fed on skimmed milk which, when suitably diluted, can be made the basis for fat and sugar additions.

6. Malt soup is the food that in our experience proved the best milk preparation.

7. Casein milk has a useful but limited field in catarrhal enteritis, the alimentary intoxication of Finkelstein.[14]

8. Maltose answers all the requirements for a sugar in infant-feeding.

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10. Leopold: Ztschr. f. Kinderh., Dec. 22, 1910.
11. Helmholz: Arch. Pediat., May, 1911.
12. Rotch: Cardinal Principles for Successful Feeding of Infants.
13. Kerley: Arch. Pediat., March, 1908.
14. Finkelstein: Jahrb. f. Kinderh., lxv, lxviii.

ABSTRACT OF DISCUSSION

DR. THOMAS S. SOUTHWORTH, New York: The early regain of weight in such a large number of cases surprises me. In my experience in the hospital the baby's initial loss in weight is considerable. I can confirm what Dr. Neff says as to the peptonization of food for infants. It has largely failed me in my hospital work. Its value, where it is useful, is simply in changing the coagulability of the proteid, but where a child is given a formula which it cannot digest peptonization does not help matters. Malt soup mixtures with suitable milk modifications are very valuable, but it would certainly be a great mistake to go backwards and take one stock formula or one mixture and try to use it for all infants.

DR. M. DRANGA, San Diego, Cal.: I have found that in the case of babies under six weeks old, when they are unable to take other food, I can start them and they gain rapidly on condensed milk, although when admitted they would not retain barley water or any other kind of food. Condensed milk is used only until the babies are able to retain other food.

DR. LANGLEY PORTER, San Francisco: I believe condensed milk has a definite place in the feeding of infants. One of the arguments that is usually made against condensed milk is that it is low in fat and low in proteins. If any one giving condensed milk will study as carefully his formulas as he would in giving any other food, he will find it possible to augment the protein and the fat. I believe the contumely that has been heaped on condensed milk is deserved by the people who prescribe it because they do not use it as carefully as they do other forms of milk.

DR. J. P. SEDGWICK, Minneapolis: Regarding the mortality, a word from the northern section may be of interest. The twin cities, Minneapolis and St. Paul, have a population of about 500,000. There are few negroes, little poverty and little crowding. The mortality last year was between 600 and 700. The death-rate is higher during the summer, and although we do have a hot season the heat does not last as long. I remember one August, however, when eighty or ninety infants died. I have found the same condition of which Dr. Royster speaks. During some years we have a preponderance of the catarrhal type of diarrhea and in other years there is a preponderance of the enteritis type. I have been using casein milk and have found it of definite value in certain cases of atrophy and intestinal trouble. In regard to maltose, of which Dr. Neff spoke, I would like to know what form of maltose he used. Some preparations have much more dextrin than others. Maltose itself is rather expensive, costing about $3.00 a pound wholesale.

DR. R. B. TUBBS, Council Bluffs, Ia.: I cannot see why it is any more legitimate for us to give condensed milk than it is to give proprietary medicines. It has nothing in the world to recommend it but that it is sterilized. Why should we use condensed milk with 25 per cent. of sugar added to it? I cannot understand how a man can say that it does not produce scurvy. In my experience it does not agree with the babies except temporarily. I know the use of condensed milk has brought me more cases in a desperate condition than anything else. As regards the temperature as a causative factor in summer diarrheas, I believe that overfeeding has as much to do with the etiology as anything else.

DR. A. L. TILTON, Kingman, Ariz.: In the desert country of Arizona we use a great deal of condensed milk. We use it because it is, in a large number of cases, the only thing we can get. Although there are many cattle ranches in Arizona, a cattle ranch is the last place in the world where you will find milk because there is not sufficient grass near the ranch houses for the cattle to be well fed. Hence we have adopted condensed milk as the least evil, and in my limited experience in its use I have seen but one case of scurvy, and in that case no orange juice had been used. I do not think I would have permitted the use of condensed milk but for the fact that it had already been used there with success.

DR. I. A. ABT, Chicago: There is a great diversity in infant feeding. Professor Keller of Berlin collected formulas of feeding in different parts of the civilized world. He has shown that in England, in Germany, in the United States and in France they have their own methods. The fact is that babies

are raised on artificial food all over the world, and in no two countries is the same method employed. I believe that one is justified in feeding a baby according to the best experience that prevails in the section where one is practicing. If most babies in the desert of Arizona are saved by feeding condensed milk, then, it seems to me, that method of feeding is justified there at present. We still have much to learn in the matter of adapting artificial food to babies. I am in favor of every man telling his experiences according to the best light he has, and we may, in that way, be enabled to draw conclusions. Answering the gentleman who said it was wrong to use condensed milk because it was a proprietary food, I think it would certainly be wrong to sacrifice the babies for the want of it, if it will save them. I do not wish to be understood as advocating condensed milk, though I should not hesitate to use it if the supply of fresh cow's milk was for any reason unsafe or inadequate.

DR. L. T. ROYSTER, Norfolk, Va.: I have had no experience in feeding babies on condensed milk. Nine times out of ten the patients brought to me have been on condensed milk, and are in a wretched condition. I am in charge of an institution that takes foundlings. It was formerly customary to feed them temporarily on condensed milk, but I have made the experiment of feeding them on a solution of milk-sugar, and they do just as well. But those that have been put on condensed milk by the physicians have had it given them without any effort to modify it in any way, as many of the physicians knew no more about it than the mothers.

DR. W. V. C. FRANCIS, Los Angeles: I frequently put children on goat's milk; I believe that is one of the best substitutes for mother's milk.

DR. F. C. NEFF, Kansas City, Mo.: Dr. Southworth asked about the absence of the usual loss in weight of these infants. I did not mean that there was absolutely no loss in weight, but that they had regained it. We simply put them right to the wet-nurse. Whether that had anything to do with their regaining it so promptly, I do not know. As to scurvy, my statement in regard to the boiling of the milk in preparing the malt-soup was simply a quotation from Thomas, who, in 1907, objected to malt-soup because the milk had to be boiled. In my paper I have used quotation marks to show that it was not an expression of my personal opinion. Dr. Sedgwick asked about the maltose we used. The exact analysis of the malt extract preparation we used I do not know.

VERRUCA PERUANA *

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One of the most interesting diseases in South America is the one known as "verruca peruana" (*verruga peruviana*), *fiebre de la Oroya,* or "Carrion's fever," as it is called in Peru, in honor of Daniel Carrion, a young Peruvian who died as a result of his zealous attempt to determine the infectious nature of the malady which, although given the commonplace appellation of "wart," is a very serious and frequently fatal disorder.

Some knowledge of the disease is necessary to Americans, from the fact that American physicians have from time to time passed through the endemic region or have engaged in professional work in connection with some of the American commercial interests in Peru.

The disease is interesting from several points of view: to the parasitologist on account of the peculiar bodies in the erythrocytes, and on account of its probable transmission by ticks or other suctorial invertebrates having a peculiar geographic and altitudinal distribution; to the hematologist, on account of the remarkable blood-picture in the malignant form of the disease, there being a profound anemia; to the physician and quarantine officer, from the fact that the disease is rife in certain districts in Peru, where Americans have commercial interests and where American physicians and engineers, bridge-builders and other mechanics have occasion to pass through or work within infected zones. Convalescents occasionally return to the United States with some evidences of the disease still present on their persons.

It is of additional interest to Californians because one of the very few accounts of the disease by Americans is that of Browne.[1]

GEOGRAPHICAL DISTRIBUTION

Verruca peruana is an infectious disease in which a fever of irregular type, associated with more or less severe anemia, is followed by a wart-like eruption of the skin, and sometimes of the mucous or serous membrane.

Formerly, it is believed, the disease had a much wider distribution than it has to-day. It is now encountered in certain narrow valleys on the western slopes of the Peruvian Andes, between latitudes 8° and 13° South, and at altitudes of from 1,000 to 12,000 feet. It is distributed along narrow tributaries which drain into rivers flowing into the Pacific. The disease is never contracted in the lower coastal plain, but always up in the valleys at the higher altitudes mentioned, not less than 28 to 60 kilometers (16 to 36 English miles) from the sea. Neither does it cross the divide, for it is unknown on the eastern face of the Andes. It is encountered oftenest at altitudes of from 2,000 to 6,000 feet.

The chief endemic areas are to be found in the departments of Ancachs in the Province of Huarez; and in S. Bartolomé, Casapalca, Chosica, and Santa Eulalia in the Department of Lima.

The mortality from verruca was so great during the construction of the Oroya Railroad, which extends from Lima to the Cerro de Pasco mines, that one of the large bridges crossing the river is known generally as "Verruca Bridge."

Peruvian physicians believe that only by sleeping in an infected district or by passing through it at night can the disease be contracted; and it is generally believed that the disease is transmitted by the bite of an insect. This naturally suggests a carrier in the shape of a tick or mosquito, or other suctorial invertebrate having a peculiar altitudinal distribution.

CLASSIFICATION

Two forms of the disease are recognized: the malignant and benign.

Malignant Form.—This is known as "Oroya fever," "Carrion's fever" or *fiebre grave verrugas.* The initial stage of this form corresponds with that usually noted in severe acute infections. The second stage constantly exhibits fever of an irregular remittent or intermittent type. There is a rapidly progressive and severe anemia, the erythrocytes falling below 1,000,000, sometimes even to 500,000 per 1 c.mm. There is poikilocytosis, polychromatophilia, enormous numbers of nucleated red cells, leukocytosis and high color index. Coincident with the anemia there is vertigo, great restlessness and air hunger. The sensorium is always clear and the mortality very high. The third or eruptive stage occurs in the small percentage of patients who recover from the *fiebre grave.*

* Read in the Section on Pathology and Physiology of the American Medical Association, at the Sixty-Second Annual Session, held at Los Angeles, June, 1911.

1. Browne: Verrugas and Arroyas Fevers, Tr. Med. Soc. Cal., 1872-1873, p. 173.